Abstract

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Overcoming electrode polarization effects: development of a label-free aptamer-based nanogap capacitive biosensor

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Abstract

A significant impediment to the use of impedance spectroscopy in bio-sensing is the electrode polarization effect that arises from the movement of free ions to the electrode-solution interface, forming an electrical double layer (EDL). The EDL screens the dielectric response of the bulk and its large capacitance dominates the signal response at low frequency, masking information particularly relevant for biological samples, such as molecular conformation changes and DNA hybridization. The fabrication of nanogap capacitors with electrode separation less than the EDL can significantly reduce electrode polarization effects and provide enormous improvement in sensitivity due to better matching of the sensing volume with the size of the target entities. We report on the fabrication of a horizontal thin-film nanogap capacitive sensor with electrode separation of 40 nm that shows almost no electrode polarization effects when measured with water and ionic buffer solutions, thereby allowing direct quantification of their permittivity at low frequencies. Functionalization of the electrodes with thiol-immobilized single strand DNA (ssDNA) aptamers transforms the device into a label-free biosensor that has high sensitivity and selectivity towards the detection of a specific protein. Using this approach, we have developed a biosensor for the detection of human alpha thrombin.

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Biography

Zahra Saribral has completed her PhD Cambridge Educational Group. 7 years of experimental science research (2010-2017) in Physics, Biology, Chemistry, SolidWork (SOLIDCAM), AutoCAD (desktop) and SketchUp (Pro) software.Electrical circuit design and fabrication with thin film Engineering and Mathematics.

Able to make 3D designs in technology. Experience in working with variety of metal thin film fabrication (Au, Cr, Ag, Al) in thermal and Electron-beam evaporator deposition systems, design and fabrication of Metal-Oxide-Semiconductor (MOS) devices, expert in fabrication of Silicon dioxide insulator layers with various deposition heat and Argon and oxygen mixture for different purpose

